

■ Nuclear industry's safety and response in case of accident

Introduction

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Every industrial activity poses a potential threat to the workers, the population and the local or even global environment. Accidents at industrial installations like oil platforms (BP Deepwater Horizon Oil Spill), chemical firms (Bhopal disaster, AZF factory explosion in Toulouse) or steel factories (aluminium factory in Ajka, Hungary) often hit the headlines. The nuclear industry is of course no exception and a severe accident at a nuclear power plant (NPP) could have major consequences. The Chernobyl accident in Ukraine and the Three Miles Island one in the US are there to remind us of that. However the safety record of the nuclear industry compares very favourably with any other industry and the nuclear community does its best to make sure that it remains so. A recently-published study conducted by the OECD's Nuclear Energy Agency entitled, *Comparing Nuclear Accident Risks with Those from Other Energy Sources*¹, shows that nuclear energy represents a "very low risk" compared to other sources of energy such as fossil fuels. Moreover the nuclear community and public authorities have set up a whole range of emergency measures in order to limit the impact of such an accident and repair the damages.

"Turning now to nuclear safety and security, we have seen a very significant improvement in the safety performance of the nuclear industry since the Chernobyl disaster nearly 25 years ago. This reflects factors including improved design, better operating procedures, a strengthened and more effective regulatory environment and the emergence of a strong safety culture." Yukiya Amano, IAEA Director General, at the UN General Assembly in New York, USA, on 8 November

Safety of nuclear installations

Three-Mile Island (in the US) and Chernobyl are the only major nuclear-related accidents to have occurred during 12,000 cumulative reactors-years of commercial operation in 32 countries. This safety record compares very favourably with any other industry.

The main cause of the Chernobyl accident was the coincidental combination of severe deficiencies in the design of the reactor, the failure of the safety shutdown system and the violation of procedures. However, considerable improvements in operational efficiency, technological advances, and the stringent controls,

¹ The recently-published study of the OECD's Nuclear Energy Agency indicates that "between 1969 and 2000, there were 2259 and 3713 fatalities in the coal and oil energy chains respectively in OECD countries and 18017 and 16505 fatalities in non-OECD countries. Hydropower was responsible for 29924 deaths in one incident in china. In contrast, there has only been one severe accident (defined as resulting in 5 or more prompt fatalities) in nuclear power plants over this period of time, Chernobyl, which resulted in 31 fatalities."

inspections and safeguards that have been put in place since then make it extremely unlikely that another Chernobyl will take place. Indeed, no major nuclear accident has occurred in the 22 years since Chernobyl.

Commercial reactor containment structures — made of steel-reinforced concrete several feet thick — are designed to prevent dispersal of most of a reactor's radioactive material in the event of a loss of coolant and meltdown. The two meltdown accidents that have taken place in power reactors, at Three Mile Island in 1979 and at Chernobyl in the Soviet Union in 1986, illustrate this phenomenon. Both resulted from a combination of operator error and design flaws. At Three Mile Island, loss of coolant caused the fuel to melt, but there was no fire or explosion, and the containment prevented the escape of substantial amounts of radioactivity. At Chernobyl, which had no containment, a hydrogen explosion and a fierce graphite fire caused a significant part of the radioactive core to be blown into the atmosphere, where it contaminated large areas of the surrounding countryside and was detected in smaller amounts literally around the world.

International and EU legislation on nuclear safety

The Convention on Nuclear Safety was adopted on 17 June 1994 by a Diplomatic Conference convened by the International Atomic Energy Agency at its Headquarters in Vienna from 14 to 17 June 1994. Its aim is to legally commit participating States operating land-based nuclear power plants to maintain a high level of safety by setting international benchmarks to which States would subscribe. The obligations of the Parties cover for instance, siting, design, construction, operation, the availability of adequate financial and human resources, the assessment and verification of safety, quality assurance and emergency preparedness. The Convention is an incentive instrument.

On 25 June 2009, at an Environment Council in Luxembourg, the European Council adopted the Proposal for a new Directive on nuclear safety. The Proposal, entitled "Setting up a Community Framework for Nuclear Safety" aims "to achieve, maintain and continuously improve nuclear safety and its regulation in the Community and to enhance the role of the regulatory bodies."

In the immediate aftermath of Chernobyl, the International Atomic Energy Agency gave high priority to addressing the safety of nuclear power plants, especially in some areas of Eastern Europe, where deficiencies remained. The RBMK reactor model in Chernobyl was never built outside the former Soviet Union as its design characteristics would never have allowed it to receive a permit elsewhere. Nuclear world-wide operators realised then that the consequences had an effect on every nuclear power plant and international cooperation was needed to ensure that such an accident can never happen again. WANO was formed in May 1989 by nuclear operators world-wide uniting to exchange operating experience in a culture of openness, so members can work together to achieve the highest possible standards of nuclear safety. The culture of openness allows each operator to benefit and learn from others' experiences, challenges and best practice, with the ultimate goal of improving nuclear plant safety, reliability and performance levels for the benefit of their customers throughout the world.

Safety remains the European nuclear industry's top priority. It covers all the technical and organisational measures taken at all stages of the design, construction, operation and decommissioning of the facilities, so as to ensure normal operation, prevent accidents and limit their impact on health and the environment. Highly qualified staff is also one of the pillars of the industry's strong safety culture. Risk prevention, surveillance and the construction of successive physical barriers to minimize the release of radioactive materials to the environment should a major accident happen all contribute to the industry's safety measures. Nuclear facilities are operated under the strict control of international organisations like the IAEA, EURATOM and national regulatory authorities. The nuclear industry is the most regulated of all industries.

Response in case of accident

Although a severe nuclear accident is unlikely to occur, nuclear operators take full responsibility for any damage caused by its activities regardless of fault and commit to confine radiological releases, protect the population and take appropriate recovery actions.

The true impact of Chernobyl

Extensive analysis that has been carried out ever since the disaster occurred has indicated that the confirmed Chernobyl-related health effects have not been as substantial as initially feared. Scientists did not observe serious negative health impacts linked to the accident in the general population in surroundings areas, nor did they find widespread contamination that would continue to pose a substantial threat to human health, except for in a few exceptional, restricted areas.

31 people died as an immediate consequence of the accident. Nineteen more have died in 1987–2004 of various causes; however their deaths are not necessarily — and in some cases are certainly not — directly attributable to radiation exposure. Among the 200,000 workers, who were exposed to high-level radiation doses from 1986 to 1987, an estimated 2,200 radiation-related deaths can be expected during their lifetime. A report published by the IAEA and the World Health Organisation entitled the Chernobyl Forum Report, which was published in 2005, concludes that up to 4,000 people could eventually die prematurely of radiation exposure resulting from the accident.

A more secure and permanent confinement structure will be built around the sarcophagus which covers the remains of the damaged unit. This will help to ensure that there is even less chance of serious health impacts occurring in the future.

<http://www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf>

An accident could result in the release of dangerous levels of radioactivity that could threaten the health and the safety of the surrounding population and affect the local environment. Therefore, to limit the impact of a nuclear accident, electric utilities, regional and national authorities and regulators have emergency response plans. The operator must prepare an emergency response plan in order to bring the accident under control and limit its consequences, protect the nuclear workers and inform the responsible authorities. Local authorities are usually in charge of protecting the neighbouring population, properties and the environment threatened by radioactive contamination. At national level, the relevant Ministries are responsible for co-ordinating the actions and reporting the accident to international bodies or foreign States when it is deemed necessary. The nuclear safety regulator advises the government and other actors on health and safety measures to be taken. Emergency response exercises are regularly carried out to test the plans and improve them. As the Chernobyl accident has demonstrated, a nuclear accident can have consequences even outside the border of the State where it took place. Thus international conventions require States to notify an accident which has potential cross-border consequences to the competent international organisation and directly to affected States.

To cover damages, nuclear operators are required in most countries to be covered by insurance. International conventions provide for the so-called “international liability regimes” to address cross-boundary consequences. National legislations also regulate nuclear liabilities and limit them in time and amount, so that the state can assume responsibility ultimately if the amount exceeds what is covered by insurances. Only one EU country with nuclear power plants — Germany — has unlimited liability for operators, but Sweden has just approved such a measure and Finland is also planning to do so.

Conclusion

Nowadays the safety culture of the nuclear industry is taken as a good example to follow for other industries. In the United States, senior nuclear figures explained recently to the US oil spill commission created following the BP oil slick in the Gulf of Mexico how the nuclear industry used self-regulation to improve its levels of safety and performance. A recently-published Eurobarometer survey found that 59% of European citizens believe that NPPs are safely operated. This shows that the nuclear industry has built confidence and continues to do so by constantly reviewing and improving safety measures to ensure that nuclear installations comply with the highest safety standards.

Annexes

IAEA Convention on Early Notification of a Nuclear Accident

Adopted in 1986 following the Chernobyl nuclear plant accident, this Convention establishes a notification system for nuclear accidents which have the potential for international cross-border release that could be of radiological safety significance for another State. It requires States to report the accident's time, location, radiation releases, and other data essential for assessing the situation. Notification is to be made to affected States directly or through the IAEA, and to the IAEA itself.

The European Community Urgent Radiological Information Exchange (ECURIE) is the European early notification in the event of a radiological or nuclear emergency. The possibility of sending ECURIE Information messages was introduced by the European Commission in 2001 to implement the decision of the 1987 European Council that mandated an early notification and information exchange system. It requires from the ECURIE Member States that they promptly notify the European Commission (EC) and all the Member States potentially affected when they intend to take counter-measures in order to protect their population against the effects of a radiological or nuclear accident. The EC will immediately forward this notification to all Member States. Following this first notification, all Member States are required to inform the Commission at appropriate intervals about the measures they take and the radioactivity levels they have measured. All 27 EU Member States have signed the ECURIE agreement, as well as Switzerland. Turkey has also been invited. ECURIE is operated by the Joint Research Centre.

Nuclear liabilities

Principles:

- > Strict liability of the nuclear operator (relieves the victim from proving responsibility)
- > Exclusive liability of the operator of a nuclear installation (legal channelling of liability, regardless of the accident's cause)
- > Mandatory financial coverage of the operator's liability (the operator must maintain insurance covering its liability)
- > Exclusive jurisdiction (only the courts in the State in which the nuclear accident occurs have jurisdiction)

International Framework:

Before 1997, there were two main conventions that covered the international liability regime:

- the IAEA's Vienna Convention* on Civil Liability for Nuclear Damage of 1963 (entered into force in 1977), and
- the OECD's Paris Convention on Third Party Liability in the Field of Nuclear Energy of 1960 which entered into force in 1968 and the 1963 Brussels Convention that provides supplementary funding via state budgets.

Some of the new EU states from central and Eastern Europe are parties to the 1963 Vienna Convention on nuclear liability. Most of the Vienna states, but not all the Paris states, have adhered to the 1988 Joint Protocol that links the two conventions. Five EU states are not party to any convention. The Vienna Convention was revised in 1997 and the Paris Convention in 2004 to raise the amount of compensation for damages significantly, broaden the heads of damages to include environmental damage, and lengthen the period during which claims can be brought from 10 to 30 years. The new Paris/Brussels Convention has not yet entered into force. Austria, Luxembourg, Ireland, Cyprus and Malta, all members of the EU, do not belong to any nuclear liability treaty.

The Paris Convention on 3rd Party Nuclear Liability was revised in 2004 to include minimum amounts (instead of limitations in amount) for operators and government responsibility in the event of a major nuclear accident, as well as an extended timescale and scope for the claims procedure. It has however emerged that the industry insurance is not generally willing to cover the revised operator liability conditions, and so the ratification process within signatory states has stalled. Coupled with this, there is disparity amongst the EU Member States in terms of to which liability convention(s), if any, they are party. The European Commission is therefore minded to act to harmonise the situation and is undertaking consultations to this effect with the Member States and other affected parties.